MODERN Machine Shop

HOWARD CAMPBELL, Editor

Volume 6 JANUARY, 1934 Number 8

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MODERN Machine Shop

CINCINNATI, OHIO VOL. 6, NO. 8

JANUARY, 1934

Interesting Operations In The Building of Cummins Diesel Machines

BY OMAR FLUHARTY

Superintendent, Cummins Engine Company

INASMUCH as the Diesel engine is an internal combustion engine, many of the parts used in the construction of the unit are similar in design to the parts used in the ordinary automobile engine and the manufacturing operations on such parts are quite the same. However, the manufacturing schedule at the plant of the Cummins Engine Company, Columbus, Indiana, contains a number of special tools and methods which will undoubtedly be of interest to the operating executives in other plants.

The Diesel engines built by this company range in size from 40 h.p. to 500 h.p., the large engines being used mostly for railway locomotive service. The locomotive shown in Fig. 1 is one of several now in use by the Chicago, Burlington and Quincy Railroad. Each of the two power plants in the locomotive consists of a Cummins Diesel engine connected to a General Electric generator.

Among the first operations in the machining of the cylinder block is that of milling the end, as shown in Fig. 2. The feature of this operation is the large size of the cutter, which is 26 in. in diameter, and the method used to prevent the cutter from chattering during the cut. As every practical plant man knows, it is a difficult

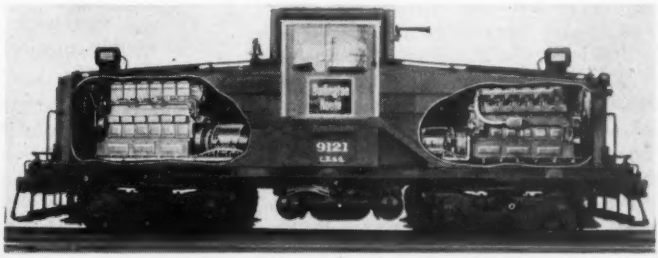
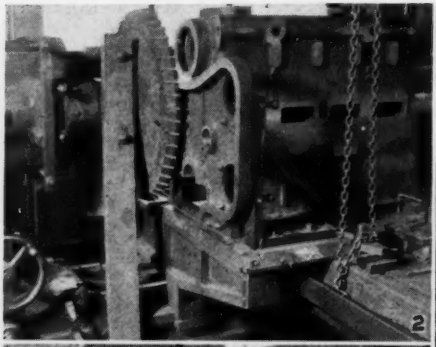


Fig. 1—Diesel-Electric Locomotive built for the Chicago, Burlington & Quincy Railroad. The illustration shows the sides cut out to show the power plants, in which Cummins Diesel engines are used.



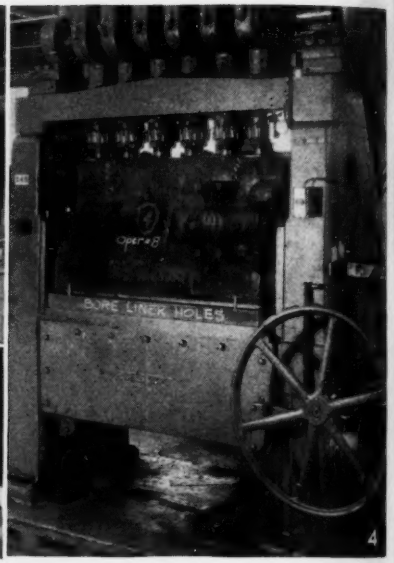


Fig. 2—Milling end of cylinder block. The brake on the spindle enables this big cutter to be operated without chatter. Fig. 3—The swing micrometer gage provides for quick and accurate setting of the machine table. Fig. 4—Boring liner holes in a cylinder block. The latest type of serrated-blade reamers are used on this job, saving time on setting up and in re-setting for sharpening.

matter to use a large cutter with a normal feed and speed without chatter. The chatter has been eliminated here by the use of a brake, consisting of two heavy hardwood strips, bolted to the spindle of the boring mill, as shown. The bolts are tightened just enough so that the spindle cannot be turned by hand, this braking pressure adding perhaps ¾ h.p. to the motor load. The pressure applied by the brake is sufficient, however, to prevent chatter, thus making it possible to obtain a smooth cut. One cut is taken on each end of the block and the overall dimension is held to within 0.003 in. of drawing specifications.

Figure 3 shows an unique method of checking the accuracy of a milling cut. The block is located on the milling machine table by means of two holes in the flange of the block which have been jig-drilled and which fit over locating pins in the machine table. The side of the block is required to be machined a given distance from the center of the camshaft bore, within a limit of 0.001 in. The rocker arms are assembled to this side of the block, and each rocker arm must be located accurately in relation to the cam shaft.

To check the accuracy of the cut, a micrometer spindle is attached to the side of the machine table by means of a swinging arm, as shown, the arm having sufficient bearing so that alignment is maintained. Having ascertained the proper setting for the mi-

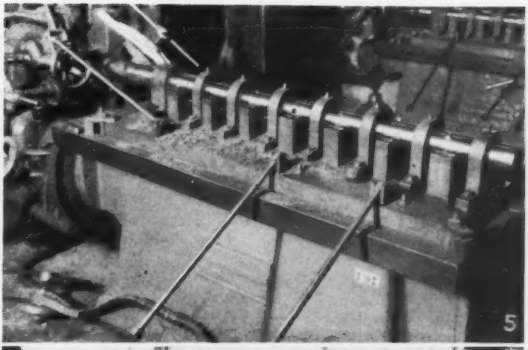


Fig. 5—Main bearings in the cylinder block are bored with this special W. F. & John Barnes machine. The spiral setting of the tools makes for smooth, even cutting.

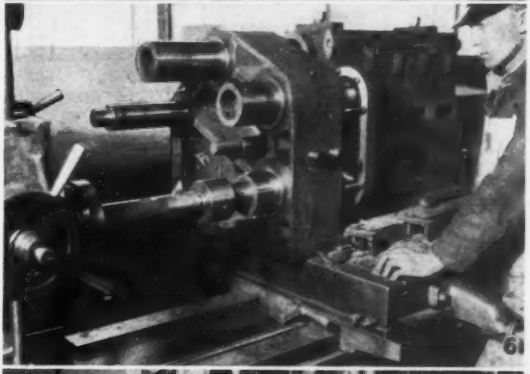


Fig. 6—Boring gear shaft holes in the end of the cylinder block. A water-cooled fixture is used, and the gear centers are held to within 0.0005 in. of drawing size.

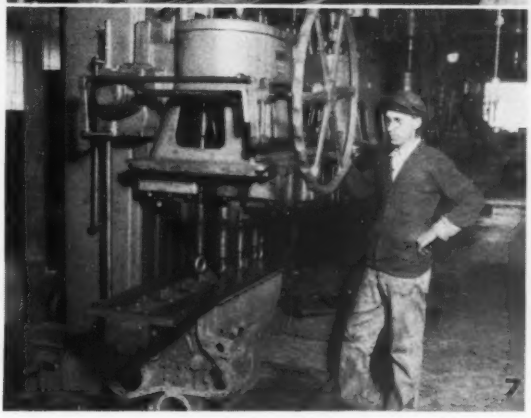
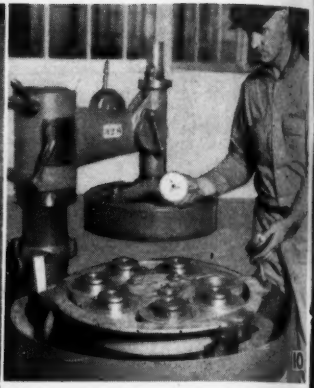


Fig. 7—All the major drilling operations on the cylinder blocks are performed with these seven Natco drilling machines.

crometer, it is an easy matter to find the exact amount of stock that must be removed from each block, or to check the accuracy of the cut. The micrometer head is swung down out of the way when not in use.

A six-cylinder engine block is shown in Fig. 4 in position for rough and finish boring the piston holes—or, to be more accurate, the liner holes. Each piston hole is bushed with a liner so that new liners can be installed whenever the old ones become sufficiently worn. In this operation the top and bottom bearing diameters for the liners are roughed and finished to size and a 30-deg. angle is formed at the ends of the liner bearings. The machining is done with O.K. serrated blade cutters, which are so designed that the cutters can be removed, replaced in a manner that expands them slightly, and reground in a minimum of time.

The top of each hole is counterbored, the depth of the counterbore being held to within 0.001 in. of drawing dimension by visual inspection by the use of the indicator shown above the block at the right. The spacing



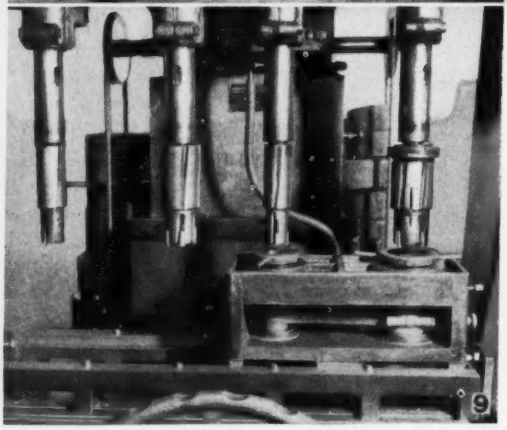


Fig. 8—Inspecting a crankshaft for a Diesel engine. Fig. 9—Tools and jig for boring the bearing holes in the connecting rod. Fig. 10—Faces of fuel pump valves are lapped in the Norton lapping machine shown in the illustration. When finished, these parts can be "wrung" together like gage blocks.

block above the cutter heads was added to carry the bushings for the boring bars. The lower ends of the bars are piloted, the pilot being located in the fixture with the pilot bearing in the end of each bar. This block is machined complete, floor to floor, in 30 minutes.

The main bearings in the cylinder block are bored with the equipment shown in Fig. 5. This machine is a W. F. & John Barnes product, specially built for this operation. The feature of this piece of equipment is the manner in which the cutting tools are located in the bar. The tools are set on a spiral, so that no two tools are cutting in the same plane; thus the load on the bar is distributed and an even torque load is maintained on the bar regardless of gaps in the bearings. Chatter is eliminated, saving wear and tear on both the tools and the machine.

Two of these machines are used, one for roughing and one for finishing. Approximately 1/32 in. of stock is left for finishing, and in the finish boring operation from 0.0015 to 0.003 in. is left for the final reaming. Production is determined by the speed of the finishing machine, which requires 7 minutes per block.

Four gear centers in the end of the cylinder block are bored to within plus or minus 0.0005 in. with the aid of the tools shown in Fig. 6. The fixture is water-cooled, and carries four boring bars, each of which is a running fit in its bearing. The block is

located on the machine table by means of a locating pin in the table, which fits into a dowel hole in the rear end of the flange, and a locating plug in the fixture which fits into the camshaft hole in the block. Each bar carries both a roughing and a finishing cutter.

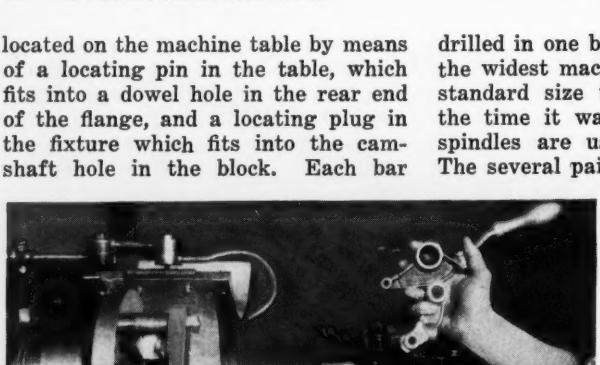


Fig. 11—Rocker arm holes are machined at a rate of 30 pieces per hour with this equipment and all dimensions, diameters, and alignments are held within 0.001 in.

An attempt was made to bore all holes at once by using a multiple spindle fixture, but it was found that so much heat was generated by the cutting process that when the block cooled the holes shrunk out of line. By boring one hole at a time it is possible to control the accuracy within the close limits required. The gears used are held to a maximum limit of 0.00075 in. on the backlash, which is necessary in order that the correct timing of the engine may be assured.

The illustration Fig. 7 shows a line of seven Natco multiple drilling machines, with which all the drilling operations on the cylinders are performed. The first machine in the line, shown in operation in the illustration, is used to drill main bearing stud holes, and as many as 14 holes are drilled in one block. The machine was the widest machine of its type in the standard size that was available at the time it was installed, and eight spindles are used in this operation. The several pairs of holes are spaced evenly except for the last pair; these two holes are somewhat closer to the preceding pair. Thus when the first six holes are drilled, the last two drills pass between the bearings. The same thing happens when the second set of six holes is drilled. Then the last two drills are used to drill the end bearing holes, during which operation the first six drills pass between the bearings.

The crankshafts for Cummins engines are purchased finished from a manufacturer who specializes on crankshaft work. Each shaft is carefully inspected for accuracy, however, upon receipt. An inspection fixture was made from a scrap engine block in which the end bearings were machined to exact size, and a pointer was dowelled to the end of the block as shown in Fig. 8. A steel disc was made for each size of crankshaft and graduated according to the throws of the shaft, so that when bolted to the crankshaft flange the throws of the shaft could be indicated for accuracy. By indicating each throw to obtain the "high spot" and checking with the graduations on the flange, this inspection is quickly made.

The spacing of the throws is checked by means of the templet shown lying on the block, and the bearings and pins are inspected for diameter with a micrometer.

The method used for boring connecting rods is common to all who are familiar with ordinary combustion work, but the tools used for this operation in this plant are worthy of mention. The tools shown in Fig. 9 are products of the O. K. Tool Company, and contain blades that are locked in place by serrations machined in the blades. The serrations on the blades are 1/32 in. apart, but the corresponding serrations in the faces of the slots are staggered so that, by moving the entire set of blades into the next consecutive slots, each blade is moved out just enough to provide for a good grind. Thus when the blades become dull, they are all moved around one slot and the tool is reground. The blades are held firmly in position without the use of pins, wedges, or screws; thus not only are the blades adjusted quickly and easily, but there are no small parts to become lost or get out of order.

The operator shown in Fig. 10 is holding a fuel pump valve, the face of which has been lapped in the Norton lapping machine shown in the illustration. Seven of these parts are lapped at a time, using a fixture in which a cap can be screwed down over each piece in order to obtain the necessary pressure. Norton lapping compound is used, 100-grain being used for roughing and 200-grain for finishing. When the pieces are removed they are lapped to a mirror finish, which is necessary in order to provide a seal for the light oil that is used in Diesel engines.

A final hand lapping operation is added, however, which produces a finish of such accuracy that two parts can be "wrung" together in the manner of Johannson gage blocks.

Each rocker arm lever contains two holes that are machined with the equipment shown in Fig. 11. The machine is a turret lathe, and the fixture is so designed that the rocker arm is locked in position between a push-out collet and a plate in the center of which is a hole with a beveled edge. Thus the work-piece locates between the collet and the bevel in the hole, which centers the outer end. The advantage offered by this method is that all holes are in the center of the stock and, considering that the center holes and the lever pin holes are held within 0.001 in. on the center dimensions and for alignment, production is as high as could be obtained by any other methods. The usual production on this operation is 30 pieces per hour.

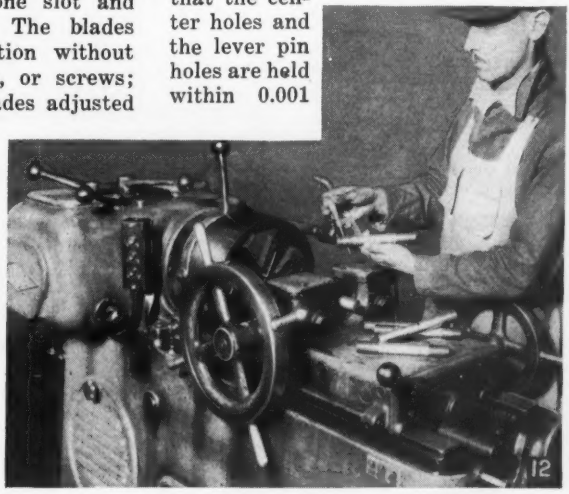


Fig. 12—With this "Landmaco" threading machine, main bearing studs 7½ in. long and with two inches of ⅞-in. thread on each end are threaded within 0.0005 in. of size on the pitch diameters and so that the threads are perfectly true with each other.

The operation shown in process in Fig. 12 consists simply of threading

PROVEN SUCCESS
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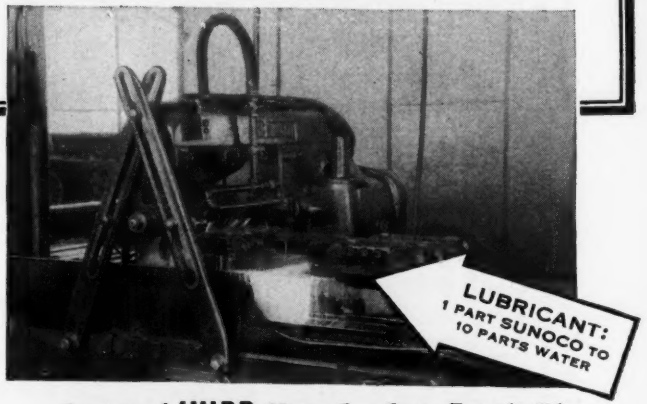
..Satisfactory performance on lathes, millers, gear hobbers, thread millers, nut tappers, bolt cutters and many other types of machine tools. ..Equal efficiency as a cutting lubricant on low carbon, high carbon, nickel or chromium steels. ..The same dependable performance on all kinds of grinding work.

Sunoco Emulsifying Cutting Oil makes possible increased tool life, greater accuracies (even at high speed) and *fewer* rejects . . . with consequently increased production . . . and *all* are advantages readily translated into *longer* tool life, accurate tolerances and perfection of finish follow the use of Sunoco in the grinding operations.

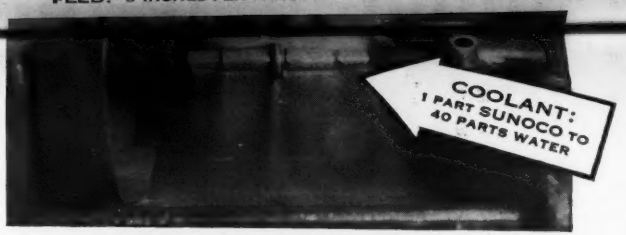


Courtesy of **HUPP** *Motor Car Corp., Fostoria Div.*

OPERATION: MILLING CRANKSHAFT COUNTERWEIGHTS.
MACHINE: CINCINNATI HYDROMATIC MILLER.
MATERIAL: COLD DRAWN STEEL.
SPINDLE SPEED: 65 R. P. M.
FEED: 8 INCHES PER MINUTE.

with consequently increased production . . . and *all* are advantages readily translated into **profit**. Longer wheel life, accurate tolerances and perfection of finish follow the use of Sunoco in the grinding operations.

Very possibly Sunoco can save money in your plant. Write today for full information.



Courtesy of **CLEVELAND TRACTOR** *Co., Cleveland*

OPERATION: FINISH GRINDING, LOWER TRACK WHEEL SHAFT. ALL BEARING DIAMETERS AND BOTH SHOULDERS.
MACHINE: CINCINNATI PLUNGE CUT GRINDER. DOUBLE WHEEL.
MATERIAL: S. A. E. NO. 1035; ROCKWELL C37.
STOCK REMOVED: .025 INCH; .010 ON SHOULDERS.
WHEEL: 24 INCH DIAMETER; 2½ INCH WIDE.
WHEEL SPEED: 1030 R. P. M.
SURFACE SPEED: 74 FEET PER MINUTE.

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the two ends of a stud, but considering the fact that the stock is heat treated material and the accuracy obtained has heretofore been considered possible only with machines of the lathe type, it is well worth noting.

The work-piece is a main bearing stud of 3140 S.A.E. steel, and has been heat treated to obtain the required toughness. The machine is a No. 1½ "Landmaco" threading machine. The studs are 7½ in. long, with two inches of ⅞ in. thread on each end. Each stud is threaded on one end and then reversed in the usual manner. The threads must be within 0.0005 in. of specified size on the pitch diameters, and the thread on one end of the stud must be absolutely true with the thread on the opposite end. Such limits have never before been met with a threading machine in this plant. The chasers will thread 200 pieces—400 threads—between grinds, which, considering the toughness of the material, is a remarkable record.

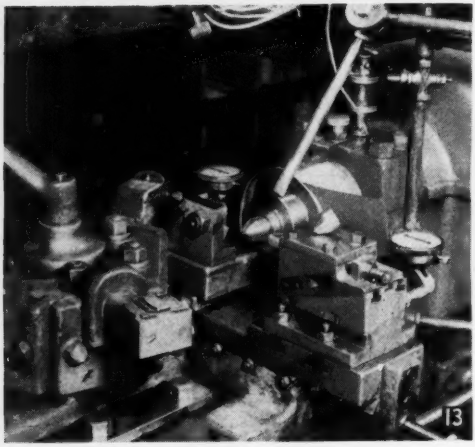

Fig. 13—The injector cap is machined all over and all dimensions, including two inside and two outside tapers, are held within limits of 0.003 in. All fits and tapers are perfectly concentric.

The operation illustrated in Fig. 13 is that of machining the outside of an injector cap. Here is a piece that is required to be machined all over within limits of plus or minus 0.003 in., including two inside tapers, and two outside tapers, all fits and tapers to be absolutely concentric with each other. All surfaces must be finished to practically mirror finishes, comprising a real job by any method or in any man's shop.

In the operation shown, the turret is used for roughing only, as the heat generated by the operation of the machine itself expands the bed sufficiently to make machining to stops inaccurate and impractical. A change in the length of the cup of 0.001 in. spoils the piece. Nose tapers and angle diameters are final-finished by the use of the slide tools. Sizes are governed by indicators mounted on the toolblock, the spindle point contacting with a ground ring on the spindle nose. The stock used for these parts is "Jalcase 1035," which is very free cutting.

Iron Paving Blocks

A firm operating a machine shop at Oldham, England, is now making cast iron paving blocks for road surfacing. An experimental length of road is being surfaced with these blocks and if they give the service expected of them, it is likely that an industry will be created which will give employment to a large force.

Each block is one foot square and weighs 20 pounds. In setting the blocks, ¼ inch of space is allowed which is filled with a solution of bituminous and bonding material, to provide the necessary bond and provide flexibility to take care of expansion and contraction. The blocks are irregularly studded, providing a non-skid surface.

Production Planning in the Small Shop

Good management, even in the small shop, must be based upon a certain amount of systematic planning. In this article the author has outlined a method of planning which, while comparatively simple, will meet the needs of the small or medium-size plant.

By Myron A. Lee
Professor of Industrial Engineering, Cornell University

THERE is frequently encountered the opinion that formal production planning is "all right for the big mass production plant, but in our shop we cannot afford any such red tape." In so far as this statement indicates a realization that a production planning system must "pay," its philosophy is sound. Any system should be susceptible of economic justification. But the statement also assumes that careful planning, while necessary in a large mass production plant, is just so much "red tape" and is unnecessary in a small shop. This reasoning is faulty. The fact is that planning is not only necessary, but is actually engaged in, formally or informally, in every shop, and it is the haphazard, informal planning that is extraordinarily expensive and ineffective.

The amount of formal production planning that is economically justified depends—not upon the size of the shop—but upon the relation of variety of product to quantity. When the variety of product is relatively high, a considerable amount of planning is imperative. Management has the responsibility of determining whether this shall be done haphazardly and ineffectually by the superintendent, foremen, assistant foremen, or even the workmen, or whether it shall be done in an orderly and effective manner by men who specialize in this function. The question is not "shall the planning be done," but "how and by whom shall it be done."

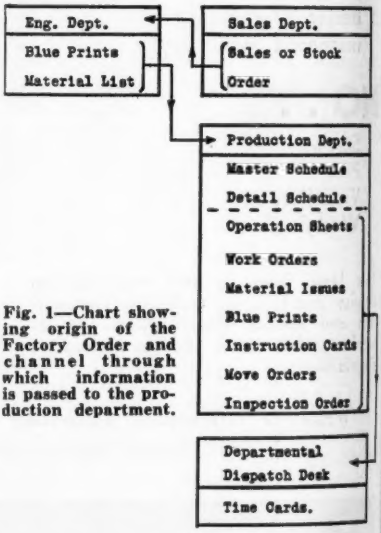

Fig. 1—Chart showing origin of the Factory Order and channel through which information is passed to the production department.

Assuming that the management,

FACTORY ORDER — MACHINE SALES ORDER No.

MODERN MACHINE COMPANY

ITHACA, N. Y.

M 10882

Ship to

Address

Bill to

Address

Terms:

Credit O. K.

Ship via

Customer's Order No.

Date

To be Ship't

	QUANTITY	DESCRIPTION

MATERIAL LIST — PRODUCTION No. A 4270

CUSTOMER — WORK

SHOP ORDER NO. — DATE — MACH. SIZE

CUST. ORDER NO. — DATE — LOT NO OR SERIAL NO.

NO. SETS REQ'D — DWGS. FROM SALES DEPT. — DELIVERY FROM SALES DEPT.

DEPT	DATE	PER	DEPT	DATE	PER
SALES			DETAIL		
ENG.			PROD		

	STD PARTS SUPERSEDED	STD. PART NO.	PART NAME	No. Req'd 1 Mach.	MATERIAL	PATT ORDER	PATT. NUMBER	

Fig. 2 (Above)—Form for Factory Order. Size 8½x11 inches. Fig. 3 (Below)—Material List. Size, 8½x11 inches.

realizing the advantages to be gained by the application to this problem of the principle of division of labor, has inaugurated a planning department, the question then arises as to how complete a system of pre-planning is justified. To answer this question a rather complete system will here be outlined.

Assuming that an order for goods to be manufactured for a customer or for stock originates in the sales department, a factory order is made out in triplicate, the original being sent to the engineering department, the duplicate to the production department, and the triplicate being retained in the sales department. A factory order form is reproduced in Fig. 2.

Upon receipt of the factory order, the engineering department forwards the necessary drawings and material list to the production department, the material list acting as a shop release. A duplicate of the material list, shown as Fig. 3, is retained in the engineering department. In the production department the order is entered on the master schedule, illustrated here in Fig. 4. This entry usually shows only the approximate productive man hours required by the order, and indicates in a general way the shop capacity required by unfilled shop orders.

DEPARTMENT 10			
Date	Item	Item Hours	Balance Hours
Dec. 20	Carried Forward		3021
Dec. 20	Order No. 2751	361	3382
Dec. 20	Hours Worked	187	3195
Dec. 21	Hours Worked	179	3016
Dec. 21	Overrun on Order 2729	18	3034

Fig. 4—Sample form for Master Schedule.

The master schedule reproduced here shows that on December 20 the man hours of work ahead of the department were 3,021. As each order is released the number of hours which each department will require for the order is added to the schedule. This is determined from the time required for previous orders for the same parts or in the case of new work the time is estimated. On December 20 Order No. 2751 was released for which the estimated time in Dept. 10 was 361 hours. This amount is entered and added to the balance, bringing the total to 3,382. Each day the total number of hours worked in each Department is received from the Cost Dept. The number of hours worked in Dept. 10 on Dec. 20 was 187, so this amount is subtracted from the balance, leaving 3,195. The same procedure for Dec. 21 leaves a balance of 3,016.

When an order is completed the total number of hours worked on that order by each department is ascertained from the cost department. This total will, of course, be practically always more or less than the estimated hours, thus requiring an adjusting

entry. On Dec. 21 it was found upon completion of order number 2729 that Department 10 had worked 18 hours more than the number originally estimated. Since from day to day the actual hours worked on this order had been subtracted from the balance it was then necessary to correct for the difference between estimated and actual hours by adding this difference of 18 hours to the balance, bringing the balance to 3,034 hours.

The next step is to check material requirements and requisition the purchasing department for materials that are not available.

Routing and Scheduling.

An operation sheet for each part is then prepared, similar to the sheet shown as Fig. 5. With the operations systematically laid out, it is possible to schedule the operations for each part so that the part will arrive at finished stores at the proper time for assembly. The schedule usually consists of some form of control board or sheet, a good example of which is shown in Fig. 6. The clerk who has charge of the control board also prepares a work order, move order, and if necessary a material requisition, instruction card, and inspection order for each operation.

Dispatching.

When the schedule indicates that the time for performing an operation is approaching, the production department sends the work order, blue print, move order, and if required, the material requisition, inspection order and instruction order for the operation to the department dispatch desk. Upon completion of the operation the department dispatch clerk returns the blue print, work order, and instruction card to the production department where the operation is indicated on the control board as having been completed. The departmental dispatch clerk also sends the time card for the operation to the payroll and cost departments for use in making up their records.

The control board reproduced here is a model board, used to illustrate the operation of one type of control board. Machines or groups of like machines are shown at the left, grouped by departments. Horizontal distances on the board represent calendar time. A slip is placed on the board for each operation, the length of the slip representing the scheduled time required for that operation. The notation on the slip can best be explained by reference to the first slip in the upper groove. The notation is X-1, 1250, 2626, 24; the significance of which is:

Part number, X-1.
Number of pieces in order—1250.
Production Order Number—2626.
Operation Number—24.

The length of the slip indicates that the scheduled time for this operation is approximately fifteen hours.

The rider on the board is simply for convenience in locating slips and reading dates. It spans one eight-hour day.

Small tabs of various colors are used to indicate reasons for delays, etc.

Upon the completion of an operation the corresponding Work Order is returned to the Production Department from the Dispatch Station and the corresponding slip is removed from the control board.

This very briefly outlines a complete routing, scheduling and dispatching scheme.

Obviously in a mass production shop, no such detail is justified. The routing is determined when the production line is first laid out. For purposes of illustration suppose a department for manufacturing automobile transmissions is being considered.

OPERATION SHEET

PART NAME Worm Gear for Adj. GL-810 CUSTOMER ______ PART NO. GL-813A

METHODS 3-13-30-HH:MV TIME STUDY (13) ORDER NO. [redacted]

QUANTITY [redacted]

OPER.	NAME OF OPERATION	TOOL NO.	NAME OF TOOLS	DEPT.	MACH. CLASS	SPEED R. P. M.	FEED	NO. CUTS	No. Per Chucking	STD. TIME Set Up.	STD. TIME Per Pc.
	The first rule in all operations is SAFETY.										
	Casting Stores			61							
1 TR	Bore, turn O.D. face & round corners	11794	Plug Gauge	52	12B					60	7.7
5 TR	Face to thickness & round corner			11	3					30	2.1
10 FT	Hob teeth	F9703	2 Bushings	18	53B	107	.044	1	4	60	34.3
		F4979	Arbor								
		1774	Test Fixture								
		HB515	Hob								
15 TM	Mill threads	11793	Fixture	18	42B	78	34			90	26.5
		F3367	Cutting Attach								
		7903	Thread Gauge								
		11794	Plug								
20 TM	Chamfer threads both sides			18	42B					25	8.5
25 ST	Stamp Piece #			21							
	Stores										

Fig. 5—Sample Operation Sheet. Size, 8½x11 inches.

The department has been laid out for, line production. The routing has been determined and fixed by this layout. Scheduling consists of stating the desired output of transmissions per day and arranging in advance for the arrival of the necessary materials at the required daily rate. Dispatching consists of checking the arrival of materials and checking the various operations to make sure that they are producing the required daily output.

In a shop where variety is greater, and consequently line production is the exception, it is generally advisable to try to arrive at an economically justified compromise in planning procedure.

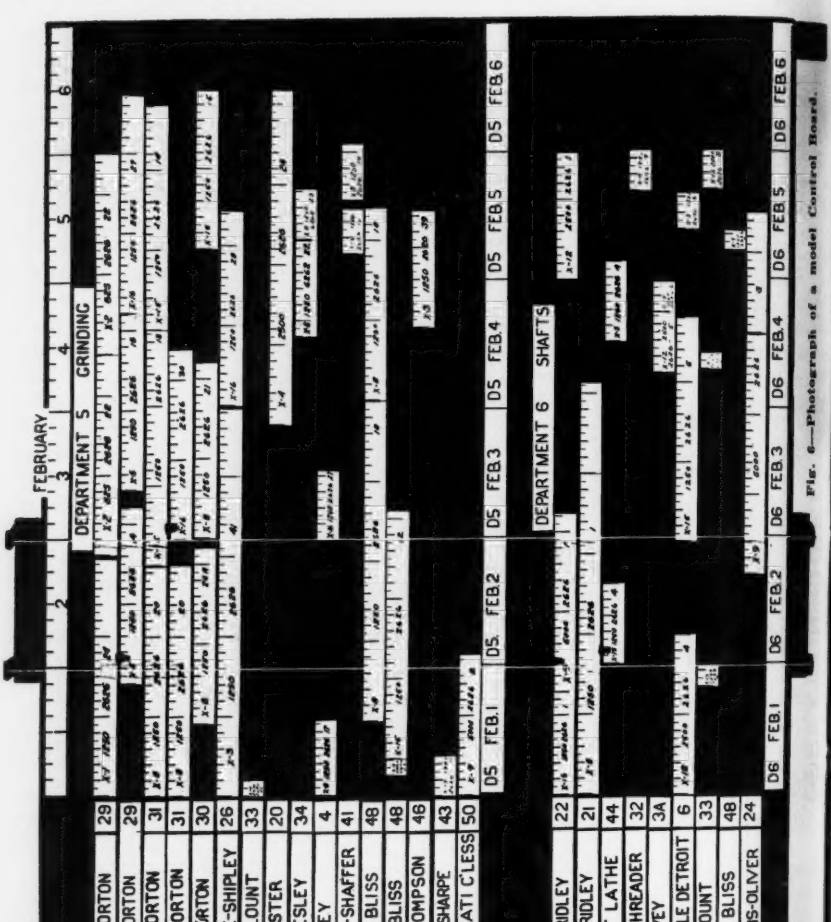

Fig. 6—Photograph of a model Control Board.

The issuing of blue prints and material lists by the engineering department may be accepted as universal practice.

The advisability of an operation sheet for every part is still doubted by some. However, no part was ever manufactured unless some one decided what the operations were to be and what their sequence was to be. Since this fact is obvious, why not designate some one to do the job who can do it well. The mere recording of the decision on an operation sheet is an inexpensive procedure. The operation sheets can be filed and used each time the manufacture of the part is repeated, thus saving the expense of redetermining the operations and their sequence each time a part

Thats news to me! I never knew before that Carboloy Co. manufactures in its own tool plant – all types of cemented carbide tools.
And they tell me that those two price reductions since 1929 have resulted in real savings in Carboloy tool cost.
I'm getting an up-to-date estimate on Carboloy tools right now! Lower machining costs will mean more orders for me these days!

*The price of Carboloy cemented carbide was reduced on September 1st, 1930, and again on June 30, 1932. These substantial reductions have resulted in greater economies on existing jobs and a wider field of profitable use on many jobs heretofore uneconomical.

Fig. 6—Photograph of a model Control Board.

is processed. It is also quite possible to use standard operation sheets for many parts. For instance, a set of standard operation sheets could be devised for the manufacture of bushings, a few standard sheets covering a complete line and being used over and over again.

To illustrate a compromise on scheduling and dispatching, the case of a well-known machine tool plant might be cited. In this plant an operation sheet is written for every part. (In some cases standard operation sheets are used.) Mechanism is available for completely scheduling and dispatching all parts, but it is only used for certain key parts.

When a lot of machines is released to the shop, the larger or more complicated parts, requiring many operations and considerable time, are completely scheduled and carefully dispatched on schedule. The small parts and those requiring only a few short operations are released with only the time when they will be required for assembly stated. It is left to the discretion of the foremen and departmental dispatch clerks to dispatch these parts.

Shortly before assembly date a shortage list for the lot is prepared in finished stores and the production department dispatch clerks then "chase" the parts which have not arrived in finished stores. This procedure obviates the necessity for detailed scheduling and dispatching of a large majority of minor parts and is apparently economically justified.

Many other "short cuts" are, of course, possible. A time card, for instance, may also be used as a work order. It may also be possible to eliminate the necessity for move orders for each operation by sending a copy of the operation sheet with the lot of pieces. Again, standard instruction sheets may be used for many operations.

(In the concluding section of this article, to be published in the February issue, Professor Lee discusses the question of tooling, and when it is or is not justified).

"TOOLS THAT GO AND GO" is the title of a book that is being issued by Goddard & Goddard Company, 12280 Burt Road, Detroit, Michigan. Intended primarily as a catalog of the tools made by this company, the book contains a wealth of information for the tool supervisor, master mechanic, purchasing department, or plant superintendent.

Section "A", listing solid cutters, is in agreement with the A. S. A. standards which have been approved by the Division of Simplified Practice. It represents the accomplishment by common agreement of practically all the milling cutter manufacturers of the United States, as to standardization of types, sizes and list prices.

Section "B" contains descriptions and illustrations of the complete line of "Go and Go" serrated blade cutters for general use. Section "C", which features heavy duty type cutters for railroad shop and similar work, contains a number of photographs of these cutters in actual use. Sections D to F contain data and illustrations on serrated blade cam lock expansion reamers, thread milling hobs and hacksaw cutters, and special tools.

Section "G" is devoted to practical information for all users of cutting tools, and contains data on the grinding of form cutters, profile cutters, and so on, together with information on clearance angles, grinding wheels to use, and so on.

A copy of this book may be had by any mechanical executive who will address his request on his firm letterhead.

THE JARVIS BIAX. The Chas. L. Jarvis Co., Gildersleeve, Conn., has issued the first number of "The Jarvis Biax", which is intended to acquaint the recipient with the products and policies of this company and, as the announcement says, provide which is hoped will be profitable entertainment. Mechanical executives will be placed on the mailing list upon request.

Jigs and Fixtures Born in the Scrap Heap, II

By A. F. Davis Vice President
The Lincoln Electric Company, Cleveland, Ohio

THAT time saved is money saved is taken for granted in every shop. One of the advantages of welded fixtures that was not stressed in the first part of this article is this very important time-saving element. Many simple fixtures can be built with the electric arc in thirty minutes or an hour. More complicated fixtures, of course, may require several days. But this time is nothing as compared with the time required for making patterns and producing castings. On a rush job, the time saved alone in building a welded fixture may pay for that fixture several times over.

As emphasized before, the use of scrap or waste materials often brings the cost of the fixture down to where labor is the only important consideration. Some manufacturers even go so far as to purchase scrap for this very purpose. In this article the writer has endeavored to show how scrap can be used to advantage. That does not mean, however, that nothing but scrap was used in the illustrations shown here. Naturally some parts had to be purchased.

Figure 8 shows two very interesting examples of what the toolbuilder can do with arc welding. At the top is shown an adjustable, collapsible fixture for welding a motor frame part. Below is a drill jig for use on the same part. To keep fixture costs at a minimum, both of these units are so designed as to be used for different size frames. It will be noted that the welding fixture has two different sets of hold-down clamps, one for each size frames. It will be noted that the welding fixture has two different sets of hold-down clamps, one for each size frame. A counterweight is

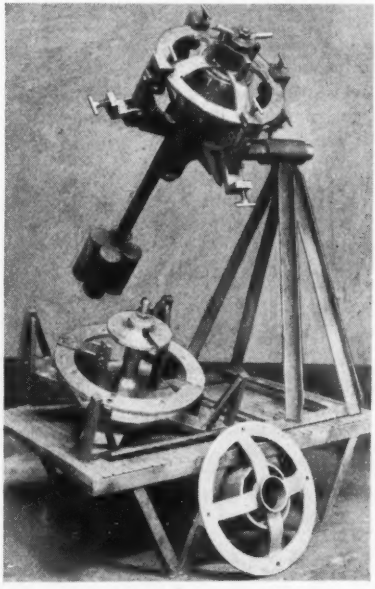

Fig. 8—A welding fixture for an exciter bracket is shown at the top, and on the skid is a drill fixture for the same part. A bracket after welding and drilling is shown leaning against the skid.

supplied so that the fixture may be rotated on the horizontal axis, and may also be turned on the vertical axis. Note the use in this fixture of

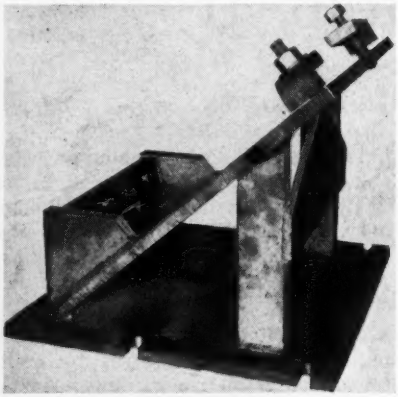

Fig. 9—An angle plate milling fixture of welded construction.

many small parts which might be obtained from any scrap pile.

The drill jig is of very simple construction. It cost approximately 40 per cent of that of a casting for the same purpose.

In Fig. 9 we have an angle plate milling fixture which cost approximately 50 per cent of the cost of pattern and casting.

Dies and die shoes may be built economically by arc welding A large tractor company which uses hundreds of dies of various sorts recently standardized on arc welded die shoes, one of which is shown in Fig. 10. This die is used in a Bliss No. 12 brake and punches twelve ¾x1 in. elongated holes in ½-in. stock. The parts punched each weigh about 300 pounds and form the sod pans that are used on large farm tractors.

The die shoe illustrated is 33½ in. wide and 52½ in. long. The base of the shoe is built of 2-in. boiler plate to which were welded six 3½x3½x7-in. die posts on each side. The bottom edges of the die posts were vee'd out before welding. Since strength is an important consideration in building a shoe for severe service, the shielded arc process employing heavily coated electrodes was used exclusively in the construction of these parts.

The die plate itself is bolted to the top of the die posts. This construction is necessary in order that the plate may be removed to be machined or to have new bushings inserted. The weight of this die and shoe together is approximately 3000 pounds—less than half the weight of a similar die and shoe formed by casting. Shoes used in this tractor plant carry loads up to 350 tons. None has shown any indication of weld failure. In addition to the 50 per cent saving in the cost of construction, other advantages are obvious. Handling is

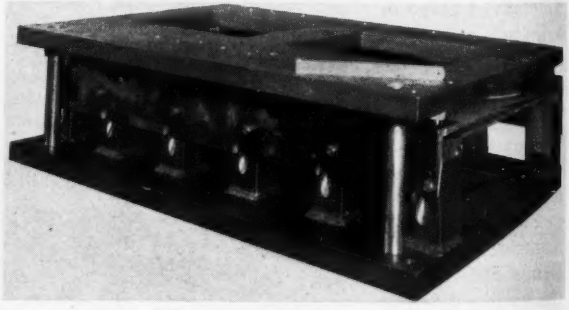

Fig. 10—This arc welded die shoe cost less than half as much as a similar shoe made from a casting.

simplified, due to the lighter weight, and steel construction provides a superior shock-resisting medium.

Figure 11 shows two boring heads with a total of 18 square holes for tool bits. The slotting of square holes is a slow and expensive operation, especially in sandy castings, whereas on the welded jobs, tool holder blocks are cut from square cold rolled steel bars and an open slot is milled in each of them so that when welded to the flat face of the center web we have a perfectly squared hole of accurate dimensions. This method is very economical. Other machining operations were done after welding.

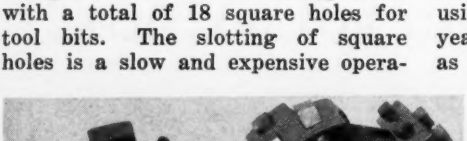

Fig. 11—Two welded boring heads.

Fig. 12 shows a welded fixture built almost entirely of mild steel plate. Constructed in this manner it is very simple. Produced as a casting it would be very expensive and would require at least twice the length of time to produce.

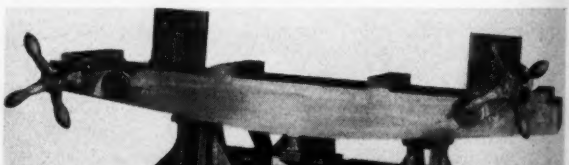

Fig. 12—A heavy duty fixture made of sections of mild steel plate, welded together.

The examples given in this article serve to illustrate the economy that is possible by utilizing arc welding in the building of jigs and fixtures and tools. The more progressive manufacturers are using this process to a greater or lesser degree, although few are using it to the fullest extent possible. One manufacturer who started using arc welding some six or seven years ago recently wrote the author as follows:

"For some time we have been building approximately 90 per cent of our fixtures by welding mild steel details together. Detail pieces are prepared by a tool maker who understands welding practice, the small pieces being cut by a power saw and the larger pieces by a torch. The joint edges are torch cut and squared by shaping. Wherever possible the original edges of the bar are used for the joint and the preliminary shaping is eliminated. The fixture is designed as far as possible to use stock widths and thicknesses of plate steel. Wherever we can we use scrap. In some cases part of the machine work is done before the details are connected by welding.

"There are several advantages which may be credited to this method of building fixtures. First—time: When it is decided to build a special fixture it is often very important to have it as soon as possible. Arc weld-

ing saves a great deal of time, the welding being under the control of the tool room foreman, and a night shift is maintained which includes men familiar with this class of work, so that a rush fixture designed through the day and given to the night shift is cut, welded and ready by the next morning.

"Second—strength: The strength of welded joints is generally well known, and mild steel is of course much stronger than cast iron. Arc welded steel construction provides maximum strength with rigidity. Even where fixtures are mishandled the steel construction usually provides sufficient strength so that they still may be used with close allowances in dimensions.

"Third—light weight: Lighter weight of steel construction is especially important on large work. Many larger jigs and fixtures built of welded steel weigh less than half the weight of castings.

"Fourth—low cost: In most all cases welded fixtures are the most economical to build. Even if new steel is used the cost is usually decidedly in favor of welded steel construction. If scrap material can be utilized the cost is, of course, even lower."

This letter sums up very well the many advantages which accrue to the user of welded steel fixtures. It should be emphasized that additional economies can be made, depending almost entirely upon the ingenuity of the designer, since seemingly complex parts can be built up from angles, bars, rods and plates in a very short time and with little expense other than that of labor.

"Handbook of Arc Welding"

Marking a milestone in the literature of welding, the publication of "Procedure Handbook of Arc Welding Design and Practice" makes available in one volume complete and up-to-the-minute information on both design and procedure for arc welding.

The book contains 434 pages with about 500 illustrations and drawings, divided into eight principal sections or parts. Each part deals with an important phase of arc welding and its application in a clear, concise manner, amply illustrated. The book is prepared not only for the use of all welders and heads of welding departments, but also for those responsible for the design of products which may be built by welding.

The eight sections of the book cover the following subjects:

Part I—Welding Methods and Equipment.

Part II—Technique of Welding.

Part III—Welding Procedure, Speeds and Costs.

Part IV—Structures and Properties of Weld Metal.

Part V—Weldability of Metals.

Part VI—Designing for Arc Welded Steel Construction of Machinery.

Part VII—Design for Arc Welded Fabrication of Steel Structures.

Part VIII—Typical Applications of Arc Welding in Manufacturing Construction and Maintenance.

Among the subjects treated in detail are descriptions of various welding processes, definitions of welding terms, classification of welds, strength of welded joints, tabulations of speed of welding all types of joints in all positions, methods for estimating cost of weld production, structures and properties of weld metal, specifications for steels and alloys of good weldability, the welding of nonferrous metals, construction details of basic machine parts built by welding, arc welding in production and maintenance machine shops and hundreds of other interesting subjects.

The book is 5¾ x 9 in. and is bound in semi-flexible simulated leather embossed in gold. It is published by The Lincoln Electric Company, Cleveland, Ohio. Price, $1.50, domestic postage prepaid. Foreign postage 35 cents.

"STAMPINGS" is the title of a bimonthly house organ now being issued by the Detroit Stamping Co., 3445 West Fort St., Detroit, Michigan. Information of interest to users of stampings, washers, and arbor spaces is included in the various issues. Copies are sent gratis.

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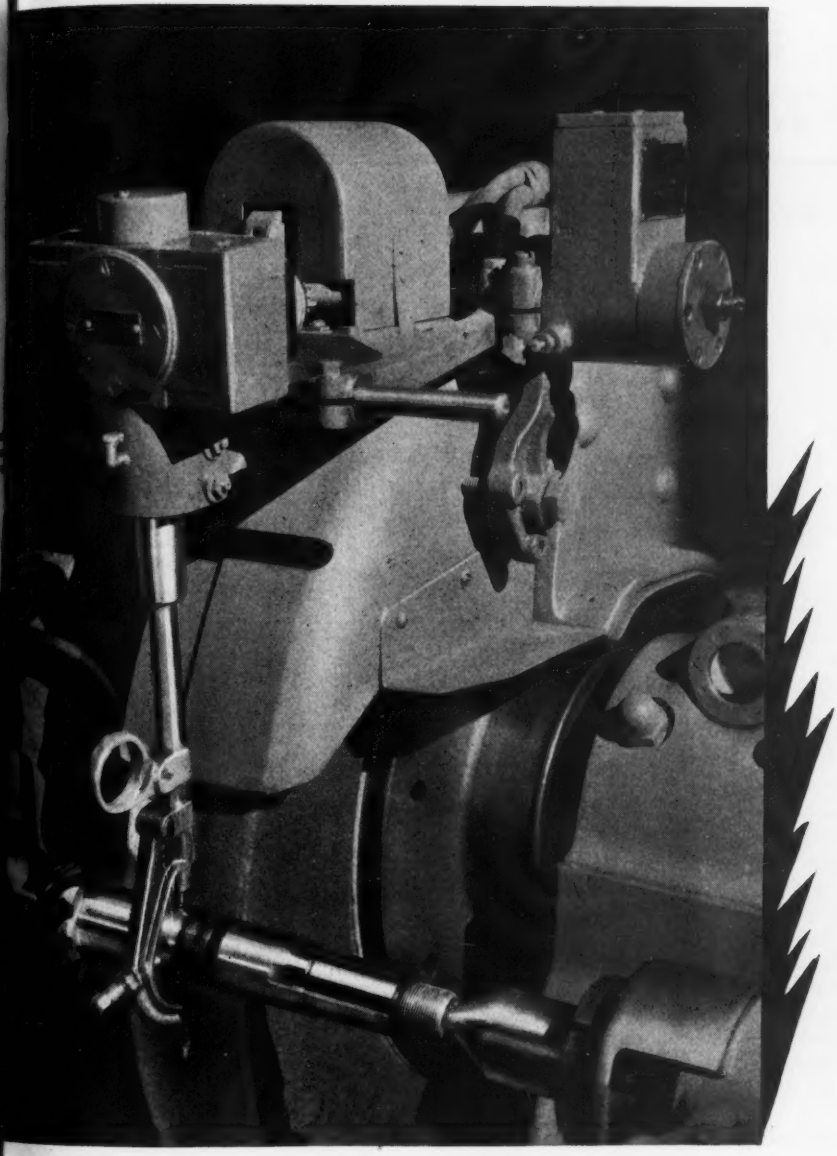

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IDEAS FROM READERS

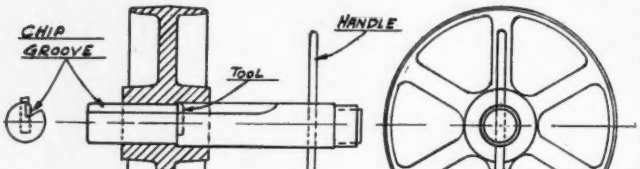
This department is a clearing house for ideas . . . If there is a "kink" or short cut in use in your shop, send in a description of it . . . Each one published will be paid for.

Reboring a Pulley Hub Under Difficulties

By Ferdinand E. Fick

THE writer was called upon to rebore the hub of a large pulley on a job in a remote locality, where no machine large enough to swing the job was available. To ship the pulley to the nearest shop in which such a machine was located would involve disassembling the pulley, transporting it to the railroad, and shipping it by freight, then waiting several days for it to be returned. Not only would the direct expense involved be high, but a considerable loss would be sustained through inability to operate while the machine was shut down. It was up to us to devise a method of reboring the pulley on the job, which we did by the following method:

A strong timber was obtained, about three times as long as the hub of the pulley, and one end of the timber was turned down to a drive fit in the pulley for a distance equal to the length of the hub. From this point back, the timber was turned to the diameter to which the pulley was to be rebored, and a tool was sunk into the timber at the intersection of the first and second diameters with the point of the tool projecting sufficiently to bore the hole to the desired diameter A liberal chip groove was cut from the tool to the end of the timber to take care of the chips, and a hole was drilled through the rear end of the timber to receive the handle, which consisted of a piece of iron. The rear end of the timber was also turned to receive an iron band to prevent the end of the timber from splitting and spreading, when struck with a sledge.



Rig for Reboring a Large Pulley By Hand

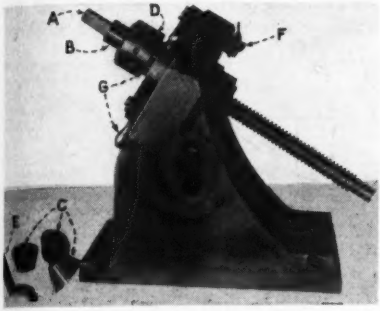
The timber was driven into the pulley until the tool was in position to cut, then it was rotated by means of the handle, the tool taking a cut with each complete revolution of the timber. After each cut, the timber was struck with the sledge, driving it in far enough to take another cut, and this process was repeated until the hole was finished. The tool was then removed and the timber was driven back out of the hole.

By using care in striking the timber, so as to drive it in the proper distance, a cut was obtained of sufficient smoothness for the purpose.

Fixture for Squaring Shaft Ends

By A. E. Granville

THE job of squaring the ends of shafts doesn't amount to much in either time or labor if the lot is small, but when the qualities of such work



Fixture for use in squaring shaft ends.

are large or frequent, it is worthwhile to have some kind of fixture for this operation. Not only does a good fixture reduce the time required, but it also insures that the squares will be accurate and of uniform size and finish.

A very good fixture for the operation of squaring shaft ends is shown in the illustration. The fixture will accommodate shafts of any ordinary length, such as the one shown at A in the illustration. This shaft is a machine feed screw, the end of which is to be squared for a hand crank. The shoulder B acts as a stop by which all shafts may be inserted into the chuck to the same distance, thus obtaining uniformity without the necessity of measuring each shaft. When squaring shafts which are made without shoulders, a scale or gage is used to obtain identical settings.

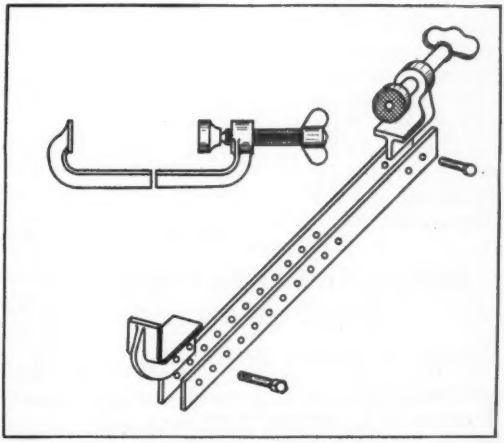
Split collets similar to those shown at C are used in the chuck to hold the work-pieces, the collets being bored to various sizes. A simple compression cap D is used to clamp the collet onto the shaft and hold it in the work spindle, the wrench E being used to turn the cap.

The fixture is made for use with a milling machine, a pair of straddle mills being used to machine the square on the shaft. The spindle is released by means of the locking pin F and is indexed by the use of the capstan handles G.

Extending the Range of the C Clamp

By C. T. Schaefer

THE "C" clamp is not generally considered as a general purpose tool, but its range of usefulness can be increased considerably if the principal handicap—the limited size of



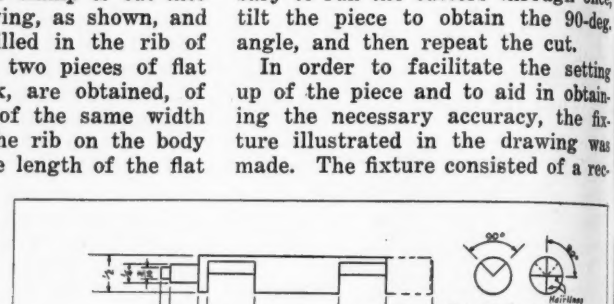
Drawing showing method of using flat pieces to extend the utility of the C clamp.

the opening—can be overcome. This can be done by the method shown in the illustration.

The body of the clamp is cut into two pieces by sawing, as shown, and two holes are drilled in the rib of each piece. Then two pieces of flat stock, ½ in. thick, are obtained, of equal length and of the same width as the width of the rib on the body of the clamp. The length of the flat stock can be varied to suit the purpose for which the clamp is to be used. A number of holes are drilled through the flat pieces, spaced according to the dimension between the two holes in each half of the clamp body, so that bolts can be inserted through the holes to hold the clamp body and flat pieces in the correct relation. One end of the clamp body can be bolted firmly, leaving the other end for adjustment.

be exactly on the line of the axis of the piece, with flat sides at angles of 90 deg. from each other, it was necessary to run the cutters through once, tilt the piece to obtain the 90-deg. angle, and then repeat the cut.

In order to facilitate the setting up of the piece and to aid in obtaining the necessary accuracy, the fixture illustrated in the drawing was made. The fixture consisted of a rec-



Drawing of block for milling knife edges on a meter pin.

Milling Knife Edges on a Meter Shaft

By Walter Ashton

IN THE building of a meter for experimental purposes it became necessary to make a pin in which two slots were milled crosswise in such a manner as to produce knife-edges of close accuracy and in perfect alignment. As the edges were required to

tangular cast iron block 3⅛ in. long in which a hole was bored lengthwise to receive the work-piece. The block was held in a vise on the milling machine table, and a slot ⅛ in. wide lengthwise of the block, together with a 1/32 in. relief on the side, made it possible to grip the piece when the vise-jaws were tightened.

Two slots were milled crosswise of the fixture to insure correct setting

(Continued on page 61)

FORMICA GEAR CUTTERS

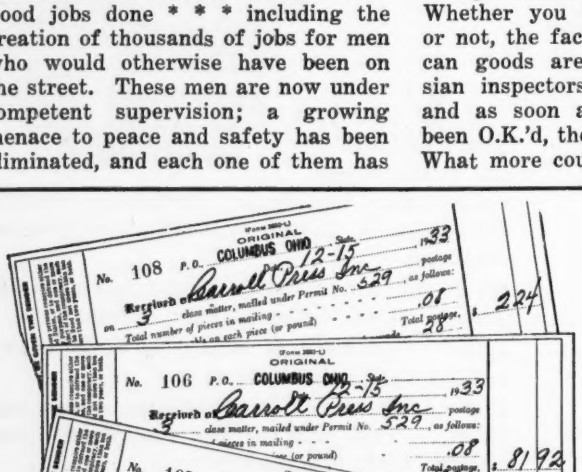
The Akron Gear & Engineering Co., Akron, O.; Farrel-Birmingham Co., Inc., Buffalo, N. Y.; Slaysman & Company, Baltimore, Md.; Harry A. Moore, Bangor, Me.; The Union Gear & Machine Co., Boston, Mass.; The Atlantic Gear Works, Brooklyn, N. Y.; Chicago Rawhide Mfg. Co., Chicago, Ill.; Perfection Gear Company, Chicago, Ill.; Merkle-Korff Gear Co., Chicago, Ill.; The Chicago Gear Co., Chicago, Ill.; The Cincinnati Gear Co., Cincinnati, O.; The Horsburgh & Scott Co., Cleveland, O.; The Stahl Gear & Machine Co., Cleveland, O.; The Master Electric Co., Dayton, O.; The Adams Company, Dubuque, Ia.; The Ferguson Gear Co., Gastonia, N. C.; Hartford Special Machinery Co., Hartford, Conn.; Precision Machine Co., Milwaukee, Wis.; Joaquin Alemany Lopez, Havana, Cuba; The Generating Gear Co., Milwaukee, Wis.; New Jersey Gear & Mfg. Co., Newark, N. J.; J. Morrison Gilmour, 151 Lafayette St., New York City; Sier-Bath, Inc., New York City, N. Y.; E. M. Smith Machine Shop, Peoria, Ill.; The Earle Gear & Machine Co., Philadelphia, Pa.; Rodney Davis and Sons, Philadelphia, Pa.; The Pittsburgh Machine & Supply Co., Pittsburgh, Pa.; Standard Gear Co., Pittsburgh, Pa.; The Turley Gear & Machine Co., St. Louis, Mo.; Perkins Machine & Gear Co., Springfield, Mass.; Winfield H. Smith, Inc., Springville, N. Y.; Alling Lander Co., Sodus, N. Y.; Charles E. Crofoot Gear Corp., South Easton, Mass.; Arlington Machine Co., St. Paul, Minn.; Farwell Mfg. Co., Toledo, O.; Diefendorf Gear Corp., Syracuse, N. Y.; Worcester Gear Works, Worcester, Mass.; The Massachusetts Gear & Tool Co., Woburn, Mass.

Over the Editor's Desk

IN wishing our readers a "Happy New Year", we note the increasing indications that our wish is already on its way to fulfillment * * * And who doesn't like to bet on a sure thing * * * As for ourselves, this issue of MODERN MACHINE SHOP carries the advertisements of eighteen new clients * * * Eighteen more firms who have a part in presenting this magazine to the executives of the industry in return for an opportunity to place the stories of their tools, machines, and other products before the users of such equipment * * * *

1933 can be credited with a few good jobs done * * * including the creation of thousands of jobs for men who would otherwise have been on the street. These men are now under competent supervision; a growing menace to peace and safety has been eliminated, and each one of them has a job, with all that it means to his morale * * * We are a nation of individuals, each with a soul that is forged and shaped by his own thoughts, desires, and ambitions. And the spirit of the individual becomes, in the aggregate, the spirit of the nation * * * The progress of civilization depends upon jobs * * * *

Another good job done * * so it seems to us * * is the recognition of Russia. The present Russian government has bought and paid for more than $200,000,000 worth of American products * * * and is now increasing its purchases in this country. Whether you like their government or not, the fact is that when American goods are purchased, the Russian inspectors examine such goods and as soon as the materials have been O.K.'d, the money is ready * * * What more could anyone ask?



6 pieces per lb., 28 lbs. Total pieces.... 168

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Copies mailed to foreign countries, stamps affixed 122

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Total 25,621

PURSUANT to statements made on page 43 of the September issue of MODERN MACHINE SHOP, the United States Post Office receipts showing the number of copies of the December, 1933 issue of this magazine that were placed in the mails are reproduced above.

NEW SHOP EQUIPMENT

Societe Genevoise Model MP-6B Jig Borer

A jig borer of larger capacity than previous models, and equipped with a side boring head in addition to vertical boring heads, is now being offered by the Societe Genevoise d'Instruments de Physique through the American agents, The R. Y. Ferner Co., Investment Bldg., Washington, D. C.

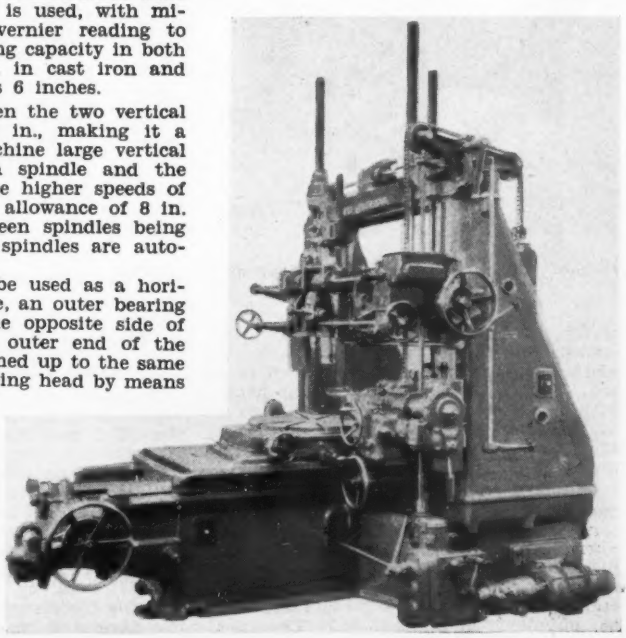
The vertical boring heads are similar in design to those of the No. 6 machine. The main spindle has a feed travel of 10 in. with 9 speed changes, from 48 to 420 r.p.m., and the high speed spindle has 4 in. of travel with speeds from 140 to 1250 r.p.m. Each has three rates of power feed. The horizontal boring head, which is mounted on the right hand column, has 12 in. of feed travel with the same speeds and power feeds as the vertical main spindle. For measuring the vertical position of the horizontal head a vertical lead screw is used, with micrometer head and vernier reading to 0.00005 in. The drilling capacity in both large spindle is 2 in. in cast iron and the boring capacity is 6 inches.

The distance between the two vertical spindles is exactly 8 in., making it a simple matter to machine large vertical holes with the main spindle and the smaller holes with the higher speeds of the other spindle, an allowance of 8 in. in the readings between spindles being necessary. All three spindles are automatically lubricated.

The machine may be used as a horizontal boring machine, an outer bearing being provided on the opposite side of the machine for the outer end of the boring bar, which is lined up to the same axis as that of the boring head by means of an extremely accurate device. Light from an electric lamp is thrown on an inclined mirror, illuminating a dotted line on a photographic recticle in the eyepiece of the attachment. The image of the illuminated line is projected to a mirror mounted in the opposite spindle, from which it is reflected back to the eyepiece. A vertical scale in the recticle indicates the amount that the pilot bearing must be raised or lowered to obtain perfect alignment of the two axes.

The machine has a circular table 31½ in. in diameter on which work can be centered accurately to facilitate the boring of horizontal holes. The table revolves on steel balls. The working surface of the rectangular table is 59 x 40½ in. The free space between the columns is 55 in., and the maximum space between the table and the nose of the spindles is 36½ in. Table travel is 52 in. A ½-h.p. motor provides power for traversing the table.

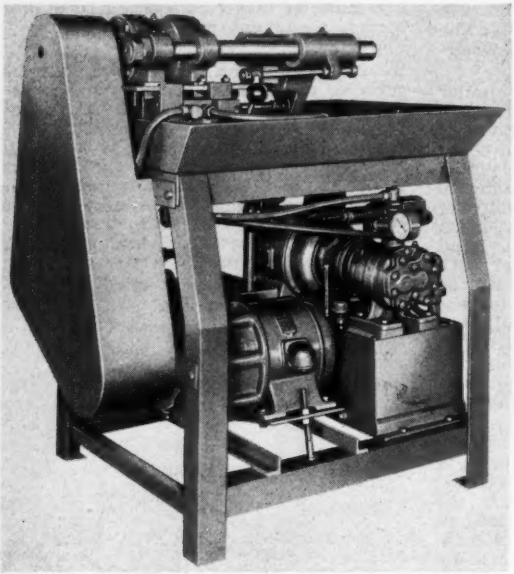
The cross rail provides 40 in. of transverse movement for the vertical heads,



Societe Genevoise Model MP-6B Jig Borer

and the rail itself can be lowered 20½ in., from 36½ in. to 16 in. above the table. Another ½ h.p. motor provides power for vertical movement of the cross rail and boring head slide. The vertical movement of the horizontal boring head is 20½ in., from 8 to 28½ in. above the table.

The spindles are driven from a 4 h.p. motor that is connected to the 9-speed gear box through a multi-disc friction clutch. Drilling or boring can be controlled from the left side of the machine when necessary. The micrometer drums are 7½ in. in diameter and are fitted with fine setting devices geared 10 to 1 to the micrometer head. The accuracy of all settings is guaranteed to 0.0005 inch.



"Logan" Automatic Hydraulic Line Reaming and Drilling Machine

Standard accessories include a dial indicator device, a center punch device, centers for the spindles, microscope and reference square, and a new type of adjustable boring tool of ½ to 6 in. range, as well as chucks, wrenches, lifting rings, and so on. A rotary tiltable table can be supplied upon request. The net weight of the machine without circular table is 8½ tons, the circular table adding another half ton.

Logan Automatic Hydraulic Line Reaming and Drilling Machine

The Logansport Machine Co., Logansport, Indiana, has added to its line of air-operated and hydraulically-operated machines the Automatic Hydraulic Line Reaming and Drilling Machine shown in the illustration. The machine is designed with a traveling carriage upon which the work to be drilled or reamed is mounted. Automatic clamping is provided by the use of the Logan Electric Hydraulic Power Device, eliminating the necessity for extra clamps and saving time in clamping.

With the work in place and the tools in position, the machine is started by the operation of a valve, the feed also being driven by the electric hydraulic power device. Seven fully automatic movements of the carriage are obtained, including rapid traverse, through the use of the Logan combination valve; thus with the machine set for the proper speeds and feeds, and with the correct tools, the operator's function is practically reduced to loading and unloading the machine and changing tools.

"Michigan" Universal Involute Gear Checking Machine

To meet the need for a universal involute checking device of modern design, the Michigan Tool Company, 7171 Six Mile Road E., Detroit, Michigan, has developed the universal involute gear checking machine shown in the illustrations. The outstanding features of the machine are said to be: (a) no master forms are required; (b) no master base circle discs are required; (c) readings are made more rapidly than by former methods; (d) charting for comparison with other checking devices is readily accomplished.

The machine employs a sine bar sim-

STEADY CONSTANT IMPROVEMENT

RESEARCH in the laboratory—research out on the grinding lines—has taught us much in this important business of cleaning room practice in the foundry. The result has been a constant steady improvement on both our high speed Redmanol bonded and the low speed vitrified grinding wheels.

There has been much in the way of manufacturing refinements—uniformity of wheel structure—balance between grain and bond—in bond density—in grain treatment.

And all of these improvement studies are evidenced in the keenness of Aloxite and Carborundum Brand Snagging Wheels—in their ability to cut with speed—to show long life—to create a state of improved grinding conditions and lowered grinding costs.

It is also significant that this research has developed new types of wheels for special foundry grinding applications. Further data on request.

Tune in THE CARBORUNDUM BAND
Saturdays at 9.30 E.S.T., Columbia Chain

ALOXITE AND
REG. U. S. PAT. OFF.
CARBORUNDUM
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BRAND FOUNDRY GRINDING WHEELS
GREATER PRODUCTION
LOWER COSTS

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

CANADIAN CARBORUNDUM CO., LTD., NIAGARA FALLS, ONT.

Offices and Warehouses in New York Chicago Boston Philadelphia Cleveland Detroit Cincinnati Pittsburgh Milwaukee Grand Rapids Toronto, Ont.

(CARBORUNDUM AND ALOXITE ARE REGISTERED TRADE MARKS OF THE CARBORUNDUM COMPANY)

ilar to those in use on other Michigan Tool Company machines, as shown in Fig. 2. The function of the sine bar, in this case, is to act as a compensator for the difference between the length of arc of 1 deg. on the friction disc that originates all of the machine movements, and the length of arc of 1 deg. on the base circle of the gear being checked. These

Fig. 1—"Michigan" Universal Involute Gear Checking Machine

various parts are shown in the illustration.

The friction disc, which is integral with the work-holding spindle, imparts movement to the sine bar carriage. Each degree of rotation of the work is shown on a scale alongside the sine bar carriage. The angular setting of the sine bar controls the movement of the indicator head, which is mounted on balls in V-grooves and counterweighted to hold it against the sine bar. The indicator head moves at right angles to the movement of the sine bar carriage so that the smaller the gear being checked, in comparison to the friction disc, the

smaller the angular setting required on the sine bar.

By the use of two indicators and a reversible indicator finger, both sides of a gear tooth may be checked without dismounting the gear, turning the gear upside down, or otherwise changing the

Fig 2—View of machine showing the sine bar, work-holding mechanism, and indicator head.

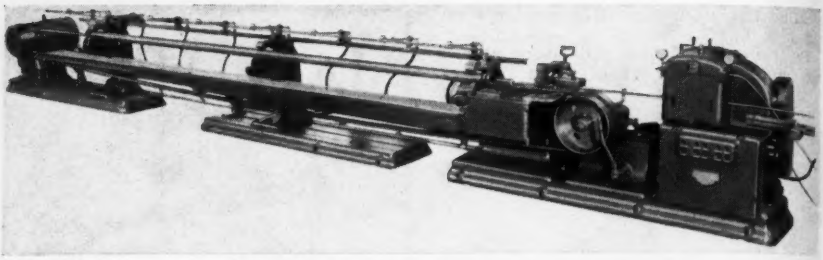
set-up. This feature insures consistent checking.

All parts of the machine are designed to withstand continuous usage over a long period of time without impairment of accuracy. The capacity of the machine —12 in. diameter by 12 in. length—is ample for all except very unusual work.

Mattison Internal Tube Grinder

Tubes and pipes can now be ground internally by the use of an internal tube-grinding machine that has been developed by the Mattison Machine Works, Rockford, Ill. The grinding operation is performed by an endless, flexible, coated abrasive belt that travels around pulleys and feeds through the tube at a high rate of speed. Suitable supporting and driving rolls hold the tube in place and revolve it during the grinding process.

The abrasive belt is threaded through the tube and made endless by the appli-



Mattison Internal Tube Grinder

cation of specially-prepared splicing tape. The splice is quick-setting, so the belt is ready for immediate use. The splice can be released for removing the belt and resetting in the next tube.

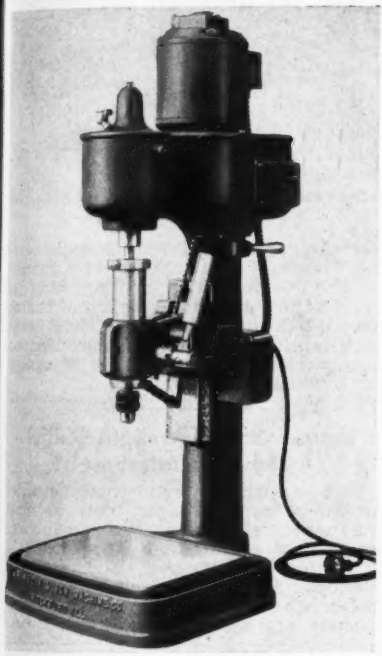
Grinding pressure is obtained by means of a pneumatic head attached to a hollow ram rod. Air under pressure is passed through the rod and into the head, which expands, causing it to exert the desired pressure against the belt. Pressure is regulated by means of a control valve. The ram rod is power-driven in both directions with automatic reverse, thus moving the grinding head forward and back through the tube. A water spray is incorporated for cooling the tube, permitting of fast cutting.

The features claimed for this machine are its economy and wide flexibility. Any desired belt speed can be had, or variable rates of revolution of the tube, variable travel of the grinding head, variable grinding pressure, and so on. Finish is determined by the grades of the abrasive grits used, and any desired finish can be obtained. The cut being longitudinal, there are no cross scratches around the inner surface. The machine can be supplied to handle tubes from ½ in. inside

diameter to any desired diameter or length.

Redin Sensitive Drill

A sensitive drilling machine in the design and construction of which is incorporated a four-speed transmission of new and efficient design has been placed on the market by A. W. Redin & Son Machine Co., 1844 Eighteenth St., Rockford, Ill. The machine, shown in the illustration, is powered by a Howell Electric Capacitator-Type Motor with interchangeable voltage of 110 to 220.



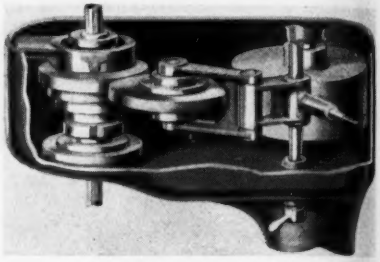
Redin Sensitive Drilling Machine

The feature of the machine is the four-speed rolling wedge transmission, which consists of a motor pulley and spindle cone pulley with a non-metallic idler held in contact with the two pulleys by means of a light spring. Due to the direction of rotation, the idler is automatically wedged in between the two pulleys only when resistance is applied to the spindle. Tests have shown that

it is impossible to stop the spindle without stalling the motor.

The shift from one speed to another is quickly and easily accomplished by simply pushing the shift lever to the rear and then up or down. The shift comb, which is located on the outside of the machine and just above the shift lever, makes damage or injury practically impossible. A brake is provided with the handle in a convenient location so that the machine may be stopped immediately and without taking hold of the chuck.

The spindle and sleeve assembly are counterbalanced by a weight on the inside of the column, giving the machine the sensitivity necessary for very light and fine work. Precision ball bearings are used throughout the entire spindle



Four-Speed Rolling Wedge Transmission for Redin Sensitive Drill

assembly, and a radial thrust-type bearing with an adjusting nut is employed in the sleeve. The drilling lever is easily adjusted without the aid of thumb screws. Banks of from two to eight heads on 9½-in. centers can be assembled on a ground surface base with an oil trough for production drilling.

Eclipse Super-Strength Radial Drive Counterbore

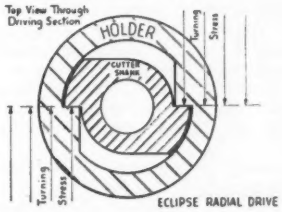
In line with the trend toward heavier machinery and stronger tools to meet the needs of modern mass production, the Eclipse Counterbore Company, 7410 St. Aubin Ave., Detroit, Michigan, has developed a new and original method of tool-driving by which counterbores countersinks, and multi-diameter boring cut-

Eclipse Super-Strength Radial Drive Counterbore

ters are assured of accuracy, alignment, and the maximum of driving power.

The drive, which is known as the Eclipse Super-Strength Radial Drive consists of radially-arranged integral abutting surfaces located between two different-sized, accurately-ground cylindrical aligned surfaces. Ground thrust bearing surfaces between the holder and cutter maintain alignment. The drive is so designed that the power is applied near the cutting edges of the tools, minimizing the amount of torque.

The double driving faces are arranged exactly on a line through the common center and only a radial or turning action can result when the assembled counterbore is in operation, eliminating wedging and spreading. These driving faces are machined from solid stock both in the holder and on the cutter shank, and, being hardened throughout, lend the greatest possible strength to the assembled tool. A simple lateral internal lock retains the cutter in positive driving position, eliminating vibration and maintaining constant thrust. No screws, pins, or vertical springs are used.



Sectional View, Showing Method of Driving

Eclipse Radial Drive interchangeable counterbores, countersinks, multi-diameter boring cutters and special end cutting tools are supplied in all standard and special sizes from ¾ in. to 4½ in. diameter, inclusive.

Stackbin Assembly Truck

An assembly truck, designed for use in transporting small parts, bolts, nuts, and similar stock about the assembly floor, or between the assembly floor and the storeroom, has been placed on the market by The Stackbin Corporation, Providence, R. I.

The truck consists of a number of standard Stackbin sections, stacked on an angle iron platform frame to which are attached two 3-in. swivel casters and two 3-in. stationary casters. The largest sections are placed on the bottom and other sections, graduated in size are placed on top as shown in the illustration. The larger pieces required for assembly are placed in the large sections and the other parts and pieces accordingly, small screws, cotter pins, and such being carried in the small top sections.

This method of handling stock makes it possible to load a truck with the correct number of parts required to assemble a given number of units and issue the loaded truck to the assembly department. The truck can be moved about as required; it keeps the material off the floor; all parts required can be kept within arm's length, and the vertical stacking of the bins makes possible the handling of a larger supply of stock with much less floor space.

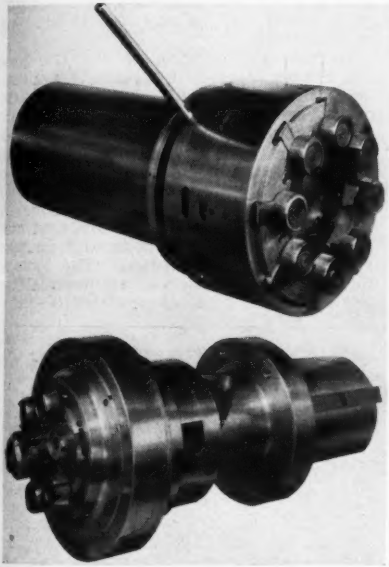
Stackbin Assembly Truck

National Acme Circular Chasers

The constant trend toward a higher degree of accuracy in cutting taper

threads on pipe and tubing, particularly in the oil industry, has made necessary the more accurate standards of the American Petroleum Institute. To meet these requirements in a commercial way the National Acme Company, Cleveland, Ohio, has produced a complete line of Circular Chaser Receding Taps from 4 in. to 13⅜ in., and a series of Expanding Dies also employing circular chasers from 1 in. to 13⅜ in. Larger sizes can be made on specification.

The fundamental idea of the circular chaser, which resembles a circular forming tool, is to present a large amount of



(Above)—National Acme Circular Chaser Self-Opening Die Head, Expanding Type. (Below)—Circular Chaser Collapsible Tap, Receding Type.

steel back of the cutting edge, so as to carry away cutting heat, and afford rigid support to the cutting edge. This means that the maximum of threads can be cut for each grind of the chaser, and because the entire periphery of the chaser can be used without change in thread form, the maximum number of grinds are possible before throwing away the remnant of the chaser.

The chasers are ground on the form and mounted rigidly on a massive steel block, being inclined on the surface of

the block in such a way that the successive chasers describe a perfect helix on the pipe. By means of a serrated bushing, on which the chasers are mounted, they can be advanced for grinding when the cutting edge is dull.

Since the chasers when sharpened are checked on a micrometer gauge on the same blocks that support them in the die head, elaborate and complicated adjustments are entirely eliminated. A set of chasers and blocks can be taken out of the die head, replaced by a sharpened set, and production resumed with a minimum of effort and delay. There is only one adjustment on the die head, and that is for pitch diameter. Chasers of a given pitch may be used on a wide range of diameters.

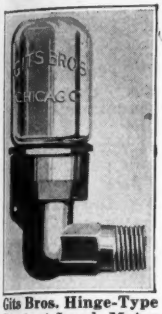
In the construction of the Die Head, the chaser block is held firmly against a hardened ground gib, supported in the outer case of the die head. It is possible by replacing these gibs to change the die head for a different taper. An inside adjustable trip mechanism operating on ball bearings permits adjustment to proper length of threaded section. All parts of the die head are made of steel, ground to close tolerances, and all wearing parts are heat treated. The tools are designed for use in any commercial type horizontal or vertical machine.

Gits Bros. Constant-Level Motor Oilers

A constant level of oil in the oil reservoir of electric motor bearings can be maintained when "constant-level" oilers are used, according to the manufacturers, Gits Bros. Mfg. Co., 1847 S. Kilbourne Ave., Chicago, Ill. Threaded for 1/8, 1/4, 3/8, and 1/2-in. pipe with bottle capacities of 5/8, 7/8, and 1 1/8 oz., the two larger sizes are interchangeable and are used in conjunction with standard oil gauges by motor manufacturers.

Style "HL" (hinge type) consists of a

body and shank made of a one-piece brass forging with a special cover hinged to the body which holds a glass reservoir or bottle with compression nut and cork packing. The bottle may be refilled without detaching by swinging it down and filling it through a tube in the cap, as shown in the illustration. When filled, it is returned to upright position without loss of oil. The oil will neither overflow the bearings nor enter the motor housing or windings.



Gits Bros. Hinge-Type Constant-Level Motor Oiler

Style "BL" (bayonet type) is for use especially where a large number of motors have to be oiled. This oiler is used where an assembly is made up for lubricating both bearings of a motor with one oiler, the unit consisting of a tee, compression fittings, and copper tubing with the oiler mounted in the center. The bottle must be removed for refilling, or may be quickly replaced from a supply of filled ones.

Style "CL", which is similar to the hinge type oiler, is made with a clamp instead of a spring. This oiler is intended for use where the motor is subject to excessive vibration, the clamp holding the bottle securely in position.

Oiler bottle in position for refilling

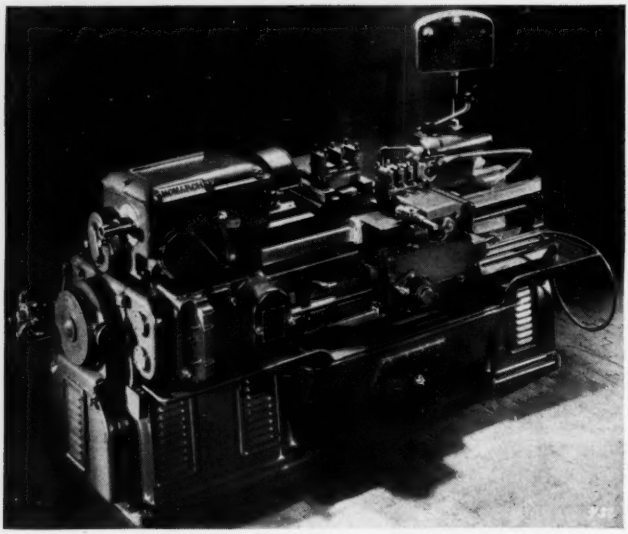
Monarch "Magna-Matic" Full Automatic Lathe

Entirely new principles of automatic lathe construction, control, and operation are said to be incorporated in the "Magna-Matic" Full Automatic Lathe, which has been developed by The Monarch Machine Tool Company, Sidney, Ohio. These features are said to provide simpler and quicker means of changing from one job to another, making the

machine especially adaptable to small lot as well as long run production.

The lathe is electrically controlled throughout, employing the principle of magnetic clutches for carriage, tool slide feeds, and rapid traverse as well as magnetic clutch and magnetic brake for spindle operation. Limit switches accurately control diameters and lengths of cut. There are four magnetic clutches in the front gear box, two of which provide length feed and rapid traverse return to the front carriage and two of which control the "in-feed" and "out-rapid-traverse" movement or the reverse of these movements to the front carriage tool slide. A convenient reverse lever on the front carriage apron makes it possible to instantly reverse the cycle of the front carriage tool slide, making it equally adaptable to out-facing or in-feeding operations.

The rear carriage is positioned manually at any point along the bed. The rear carriage tool slide is controlled automatically by two magnet clutches in the rear gear box, providing for in-feeding and out-rapid-traverse. Convenient pick-off gears in front and rear gear boxes provide feeds as follows: 0.0046, 0.0064, 0.0087, 0.115, 0.0219, 0.0296, and 0.0414 in. The rapid-traverse return is 70 in. per min. for both tool slides and front carriage.



Monarch "Magna-Matic" Full Automatic Lathe

The headstock spindle has a flanged nose and is driven through gearing and chain. A high and low gear ratio of 4.4:1 is controlled by a convenient lever. The headstock gears and pick-off gears are helical. The normal range of spindle speeds is as follows: 41, 52, 67, 84, 108, 138, 180, 229, 296, 371, 480, 610. This range can be stepped up or down as desired, either through changing the speed of the driving motor or by changing the diameter of the multiple Vee belt sheave pulley on the motor. The

spindle may be safely run at 1500 r.p.m.

The tailstock spindle is both positioned and clamped by one lever. The front carriage and tool slide are so designed as to pass the tailstock. The master control switch, shown in the elevated position at the tailstock end of the lathe, provides complete electric control for both set-up and full automatic operation of the lathe. The main starter button starts the spindle and both feeds, and the reverse button will reverse both carriages at any point in the operating cycle. Separate buttons control the front and rear tool slides.

Anti-friction bearings are used throughout. Carriages and tool slides are automatically oiled by the Monarch forced feed lubrication system. The headstock and both change gear boxes are automatically lubricated by means of an oil pump and reservoir.

The lathe may be operated to turn various diameters and lengths, when desired, by means of a single point tool on the front carriage. All tool movements are controlled by means of a templet of steel, 1/16 to ⅛ in. thick. Work is automatically produced to the shape of the templet within limits of accuracy of 0.001 in. The tools in the rear carriage can be used for facing and necking simultaneously, these tools being timed to perform their work at any point in the operation-cycle of the front carriage tools. By using the automatic feed set-up for the front carriage travel, four different feed rates can be automatically selected during the operation.

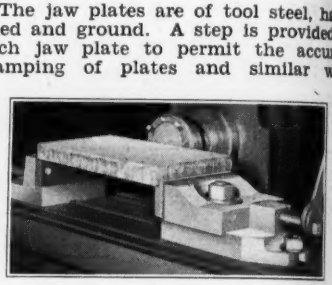
The swing over the ways is 15 in.; over the carriages is 7 in. Distance between centers, 18 in., and this can be augmented in increments of 12 in. or 18 in.-lengths to a maximum of 54 in. Range of feeds, 0.004 in. to 0.041 in. Spindle speeds are controlled by selection of pick-off gears. The size of the main driving motor, from 5 to 10 h.p., is dependent on the work to be produced. Floor space required for machine 18 in. between centers, 47 x 84 inches.

"Economy" Wide Range Vise

By using the "Economy" Wide Range Vise, marketed by J. E. Freyman & Sons, 3629 Keswick Road, Baltimore, Md., it is said that most jobs can be held in place for machining without the use of bolts or straps. The vise is made in two separate sections, each carrying a jaw, one jaw solid and one moveable by means of a screw of the usual type. In use,

the solid jaw is clamped in position, the work is located ready for clamping, and the moveable jaw is positioned against the work where the jaw-base is clamped. The screw is then turned sufficient to tighten the moveable jaw against the work.

The jaw plates are of tool steel, hardened and ground. A step is provided in each jaw plate to permit the accurate clamping of plates and similar work



"Economy" Wide Range Vise

without the use of parallel strips. The jaw plates can be reversed if the step is not desired.

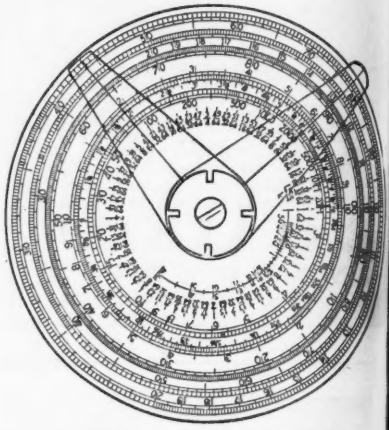
Bolts, washers, nuts, and screws are machinery steel, case hardened. The vise body is a semi steel casting and is accurately machined, with keys lengthwise only unless otherwise ordered. The vise is made in sizes as follows: 4½-in. length of jaw plates, 3 in. deep; 6½-in. jaw plates, 3¾-in. deep; 12½-in. jaw plates, 4 in. deep with two moveable tails. Larger sizes furnished on order. Two drop-forged wrenches are furnished with each vise.

"Midget" Slide Rule

The illustration shows a circular slide rule that is being marketed by the Tavella Sales Company, 25 West Broadway, New York, N. Y. Although but 4 in. in diameter, the rule is practically the

equivalent of a 12-in. rule, having a C scale that is 11¾ in. long.

The Midget slide rule is made of aluminum, white enameled and graduated in black in the usual manner. The front of the rule has eight scales as follows: a standard C scale, CI (C inverted) scale, an addition and subtraction scale, an A or square root scale, a Binary scale, a log-log scale, a fraction scale, and a thread scale. Thus the rule comprises a combination Mannheim, Polymetric, Add and Subtract, Log-Log, and Binary slide rule. The eight scales may be used



"Midget" 5-in-1 Slide Rule

in combinations that will solve complicated problems in one setting instead of the usual two or more.

The annoying matter of finding that one of the factors in a problem is off the end of the scale is impossible with this rule, because the scales are endless. Two hair-line indicators aid in making com-

putations. The Log-Log scale is divided from 1.15 to 1,000,000. The "trig" scales give the four functions from 0 to 90 degrees and the angles can be read to 1/10 of a degree or 1 minute, as desired. The rule will handle practically any combination of three factors at a setting. These factors may include second powers and roots, common and hyperbolic logs, and anti-logs.

An instruction book "The Slide Rule Manual" is included with each rule.

Armite Gall-Proof High-Temperature Thread Dope

Of interest to heavy duty machinery manufacturers and users is a new metallic lead thread lubricant, recently placed on the market by Armite Laboratories, 1900 East 65th St., Los Angeles, Cal. It is claimed to be of great value in the assembling of machinery and in the repair of equipment that is subjected to heavy duty, high temperatures, and general abuse.

The makers describe the product as being a very finely divided metallic lead in paste form, and claim that in use a film of metallic lead is formed between the threads that prevents galling, speeds up repair work, and saves on assembling time. Stud bolts on the heads and exhaust manifolds will not freeze, nor will pipe threads corrode together, regardless of time, as the lead does not oxidize or harden.

The makers also claim this lubricant used on liners and fly-wheels facilitates their insertion or removal. All press work is improved by the use of this lubricant. Even a bright red heat does not harden or destroy the compound in the threads, making it an ideal dope for exhaust studs.

FORD ROTARY FILES. Executives of metal-working plants in which hand finishing operations form a part of the processing schedule will be interested in a catalog that is being issued by the M. A. Ford Mfg. Co., Davenport, Iowa. The catalog describes and illustrates the various kinds and types of hand-cut rotary files made by this firm, and the text includes descriptions of a variety of operations upon which these files are used to advantage, together with pictures of the jobs in process.

The discussion opens with an exposition of the manner in which rotary files are made, and follows with close-up views of the files in use on such work as dies, tools, burring operations on production work, and so on. Photographs of the complete line of files in actual sizes are included, with instructions for ordering. Copies free to mechanical executives.

THE JARVIS BIAX. The Chas L. Jarvis Co., Gildersleeve, Conn., has issued the first number of "The Jarvis Biax"; which is intended to acquaint the recipient with the products and policies of this company and, as the announcement says, provide which is hoped will be profitable entertainment. Mechanical executives will be placed on the mailing list upon request.

Ideas from Readers

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of the cutters, and a line was inscribed horizontal on the end of the block at the exact center-line of the bored hole. Before machining, each pin was placed in a V-block and two lines were inscribed across the end, 90 deg. from each other, with a surface gage. In locating the work-piece in the block for milling the slots, one line was set even with the line on the block and the first cut was taken. Then the piece was revolved 90 deg. to bring the other line into alignment and the second cut was taken. This method of handling the job was simple, accurate, and inexpensive.

BRONZE BUSHING STOCK LIST. 645 stock sizes of bronze bushings are cataloged with dimensions in the new stock list "G" issued by the Buckeye Brass & Mfg. Co., 6410 Hawthorne Ave., Cleveland, Ohio. Copies gratis.

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